

Applicant: Jon R. Lesniak
Application No.: 10/039,218
Art Unit: 2877

Remarks

Claims 1–22 remain pending in the application. In the Office Action dated April 22, 2003, the examiner rejected claims 1–3, 8–16 and 20–22 as obvious over *Sharp et al.* in view of *Le Floch et al.* Claims 4 and 17 were rejected as obvious over *Sharp et al.* in view of *Le Floch et al.* and further in view of *West*. Claims 5–7, and 18–19 were rejected as obvious over *Sharp et al.* in view of *Le Floch et al.*, and further in view of "*Polarized Light*".

The preamble of the claims 1–10, and 15–22 sets forth an achromatic circular polarizer. This preamble breathes life and breath into the claims. Similarity in the method claims 11–14 the invention is drawn to a method of circularly polarizing a polychromatic beam of light, this preamble also breathes life and breath into the claims. The claims are not directed to just any assemblage of optical components, but to those assemblages of optical components that create an achromatic circular polarizer. Circularly polarized light is normally treated by combining a linear polarizer with a one quarter wave plate/retarder. A linear polarizer polarizes all wavelengths of light, however the retarder of the claimed invention is only a one quarter wave length for a particular frequency of light. Specially designed achromatic retarders which can be used to form an achromatic circular polarizer are known. These known systems are described in *West*, "*Polarized Light*", and in the application specification paragraph [0009]. These known systems have drawbacks regarding size, cost, and limited aperture.

The optical components used by applicant are known. However, a *prima facie* case of obviousness must do more than show that the parts of the claimed invention are known. The examiner must provide some suggestion, or motivation, contained in the prior art for doing what applicant has done, and some expectation of success. Further, the obviousness tests must be applied at the time of invention so as not to use applicant's disclosure as a blueprint for creating the invention.

Applicant's claimed invention utilizes four optical components to create achromatic circularly polarized light.

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Normally, two optical components (a linear polarizer and a $1/4$ wave plate or retarder) are combined to produce circularly polarized light. By using four components, applicant produces a circular polarizer which polarizes a broad band of wavelengths of light which pass through applicant's device. The first component is a linear polarizer which polarizes the broad band of wavelengths. The second component rotates the plane in which the light passing to the linear polarizer is polarized 90° . The second component is a $1/2$ wave plate which is only effective for a single wavelength for which the plate is a $1/2$ wave plate. However, for all wavelengths which are not the selected wavelength of the $1/2$ wave plate, an error, or elliptical component is introduced which is twice the error and the opposite sign as the error that a $1/4$ wave plate would introduce. This error in the non-selected wavelengths is attenuated by a third optical element until the error is one half its initial value. The fourth optical component is a $1/4$ wave plate for the same selected wavelength as the $1/2$ wave plate.

The $1/4$ wave plate produces circularly polarized light for the selected wavelength which passes the second and third optical elements as plane polarized light. The $1/4$ wave plate of the selected wavelength also produces circularly polarized light for all the other wavelengths which have passed through the first three optical components because the second and third optical elements have created an error of the proper magnitude and opposite sign as the error induced in the $1/4$ wave plate for wavelengths outside of the selected wavelength.

Sharp et al. Relates to a "liquid crystal polarizing interference filter" (col. 1, lines 17-18), and nowhere speaks of creating an achromatic circular polarizer. The examiner cites to col. 16, line 34 which claims a retarder unit which is approximately achromatic. The existence of achromatic retarder elements (unit) is well-known and admitted in the application. The *Sharp et al.* retarder element is a $1/2$ wave retarder which is approximately achromatic. Applicant's $1/2$ wave retarder is not achromatic, but for a selected wavelength. The achromatic $1/2$ wave retarder of *Sharp et al.* is positioned between a first polarizer and a second polarizer (col. 16 lines 7-9). Applicant's claimed invention requires only a single plane polarizer.

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The Examiner points out that *Sharp et al.* teach creating circularly polarized light by combining a linear polarizer and a $1/4$ wave plate. This is the standard approach to creating polarized light.

The Examiner states that it would have been obvious to use a $1/4$ wave plate after the partial polarizer as taught by *Le Floch et al.* in the *Sharp et al.* invention for the purpose of creating a circular polarizer instead of a linear polarizer. Applicant's claimed invention does not use just any partial polarizer, but a partial polarizer which creates achromatic circularly polarized light when combined with a $1/2$ and $1/4$ wavelength plates which are not achromatic. The Examiner has taken applicant's claim element "a partial polarizer" out of the context of the other claim elements, which limits the partial polarizer to one which in combination with the other elements produces an achromatic circular polarizer. Further the $1/2$ wave plate is not the achromatic plate described in *Sharp et al.* but for a selected wavelength which is the same selected wavelength as the $1/4$ wave plate.

Le Floch et al. is not to an achromatic circular polarizer but rather to an optical resonator (col. 1, lines 6-7). Within the optical resonator circularly polarized light may be created using, as the examiner suggests, a partial polarizer followed by a $1/4$ wave plate. However *Le Floch et al.* does not suggest how this arrangement can be used to create an achromatic circular polarizer. On the contrary, the resonator described in *Le Floch et al.* is used in the construction of mono-frequency and/or frequency stabilized lasers (col. 1, lines 7-8). *Le Floch et al.* does not disclose an achromatic circular polarizer and does not suggest how one could be created.

Claim 1 requires the $1/2$ wave plate, and the $1/4$ wave plate be a $1/4$ or $1/2$ wavelength retarder of the same selected wavelength. Further, the claim limitation that the optical elements be arranged to create an achromatic circular polarizer is a limitation on the partial polarizer because it is this element which makes possible the achromatic circular polarizer. The specification makes clear exactly how the partial polarizer can be related to the other optical elements to produce the claimed achromatic circular polarizer.

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Claim 11 requires passing a polychromatic beam of light through four optical elements, and specifically sets forth the generation of a wavelength dependent error, by the second optical element which is twice the magnitude and opposite in sign, to an error produced by the fourth optical element. The third optical element is claimed as attenuating every nonzero wavelength dependent error in the polychromatic beam received from the second optical element by one half. Again the claim puts very specific limitations on the third optical element or partial polarizer.

Claim 15 is similar to claim 1 but describes the orientation of each optical element with respect to the so-called "slow axis" and "fast axis" which are defined in paragraph [0004] of the application specification and are widely used in the optical arts.

Claims 2-10, 12-14, and 16-22 add further limitations which further define over the art of record. Although the individual optical elements may be known as such, their use to construct an achromatic circular polarizer, is not disclosed by the prior art.

Circularly polarized light can be difficult to conceptualize even for those skilled in the art, combining known optical elements to produce applicant's invention cannot be obvious without a clear teaching or suggestion to combine optical elements as applicant has done. The art of record contains no teaching or suggestion, but only discloses some or a few of the claimed elements. Further, because of the lack of suggestion within the references for combination, it is incumbent on the examiner to provide a convincing line of reasoning leading to a conclusion of obviousness. However, no such line of reasoning as to why the person of ordinary skill would have found the claimed invention to be obvious in light of the references has been provided.

Neither *Sharp et al.* nor *Le Floch et al.* disclose or suggest an achromatic circular polarizer or the production of an achromatic circularly polarized beam of light. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. The art of record does not provide a reasonable expectation of success. *West* which teaches an achromatic circular polarizer teaches a completely different approach—that of superimposing sheets of different birefringent,

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molecularly oriented transparent solid, organic plastic materials.

Applicant believes that no new matter has been added by this amendment.

Applicant submits that the claims, as amended, are in condition for allowance. Favorable action thereon is respectfully solicited.

Respectfully submitted,



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